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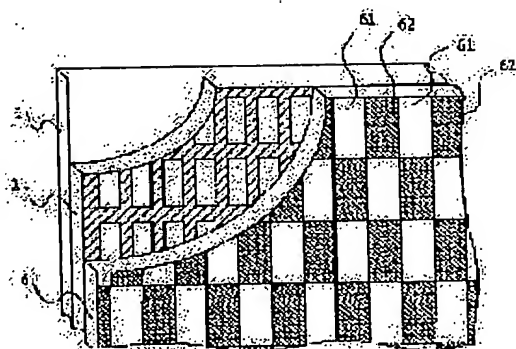
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(54) STEREOSCOPIC DISPLAY DEVICE

(57)Abstract:

PURPOSE: To provide a sharp stereoscopic image even with liquid crystal having color filters in the form of longitudinal stripes by providing an optical filter for which picture elements for left eye and picture elements for right eye are alternately arranged in all rows and columns, opening parts are provided corresponding to both the picture elements and beams from both the picture elements are splitted and emitted.

CONSTITUTION: A liquid crystal panel 2 is arranged on the front surface of a planar light unit 1, and an optical filter 6 having check-shaped opening parts corresponding to the arrangement of picture elements on this panel 2 is arranged on the observer side of the liquid crystal panel 2. Concerning the liquid crystal panel 2, the color filters are arranged in the form of longitudinal stripes so as to sharply display the longitudinal lines of images. Images in R, G and B are successively displayed in the direction of columns on the panel 2 but images for right eye and left eye are alternately displayed at adjacent picture elements in both column and row directions. Respective opening parts 61 of the optical filter 6 transmit the beams



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from the picture elements to be watched by left and right eyes and shield parts 62 shield the beams from the picture elements to be hidden.

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CLAIMS

(57) [Claim(s)]

[Claim 1] The three dimensional display equipment which comes to have the light filter which is arranged at the observer side of the graphic-display panel arranged so that the pixel for left eyes which displays the pixel for right eyes which displays the image for right eyes, and the image for left eyes may be stood in a line by turns in all line and all trains, and this graphic-display panel, has opening corresponding to said pixel for right eyes, and the pixel for left eyes, separates the light from said pixel for right eyes, and the pixel for left eyes, and acts to an observer side as Idemitsu.

[Claim 2] The light transmission mold graphic display panel arranged so that the pixel for left eyes which displays the light equipment which emits light to a plane, the pixel for right eyes which displays the image for right eyes, and the image for left eyes may be stood in a line by turns in all line and all trains, The light filter which is arranged between said light equipment and graphic display panels, has opening corresponding to said pixel for right eyes, and the pixel for left eyes, and separates the light from said light equipment, since -- the three dimensional display equipment which acts to an observer side as Idemitsu where the light which penetrated the pixel for right eyes of said graphic display panel, and the light which penetrated the pixel for left eyes are separated.

[Claim 3] Three dimensional display equipment according to claim 2 characterized by having arranged the 2nd light filter which has opening corresponding to the pixel for right eyes and the pixel for left eyes of a graphic display panel in the observer side of said graphic display panel.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Industrial Application]

[0001] About the three dimensional display equipment which can appreciate 3-dimensional scenography, without needing special glasses, this invention relates to the three dimensional display equipment which can obtain clear 3-dimensional scenography, when the electrochromatic display panel using a vertical stripe-like color filter is especially used as a graphic display panel.

[0002]

[Description of the Prior Art] The three dimensional display equipment of the parallax barrier system known as equipment which can appreciate 3-dimensional scenography, without needing special glasses from the former As shown in drawing 15, to for example, the observer side of the liquid crystal panel 2 as a graphic display panel The parallax barrier 4 with which opening 41 and the protection-from-light section 42 have been arranged by turns in the shape of a vertical stripe is formed, the light by which outgoing radiation was carried out from the light equipment 1 which emits light to a plane penetrates a liquid crystal panel 2, and the image displayed on this liquid crystal panel 2 is observed through a parallax barrier 4.

[0003] Like drawing 16, the image for right eyes and the image for left eyes were displayed together with alternation in the shape of a vertical stripe, the parallax barrier 4 separated, the image for right eyes displayed on the pixel train written to be the "right" and the image for left eyes displayed on the pixel train written to be the "left" were observed on the above-mentioned liquid crystal panel 2, and 3-dimensional scenography has been obtained by producing parallax.

[0004] And in the case of the method which made the two or more-train pixel train correspond to one opening 41 of the above-mentioned parallax barrier, and the so-called multi-eye type, 3-dimensional scenography can be observed in the larger range. The configuration of the three dimensional display equipment of 4 eye

type is shown in drawing 17 . In this drawing, the pixels 21-24 of a liquid crystal panel 2 support four view A-D, respectively.

[0005] By the way, the liquid crystal panel 2 used as display units, such as a personal computer, is the shape of a vertical stripe as the array of a color filter shows to drawing 18 , in order to display the vertical line of an image vividly. In this drawing, "R", "G", and "B" express the pixel to which red, Green, and a blue color filter corresponded, respectively.

[0006] When performing a three dimensional display using this liquid crystal panel 2, the image for right eyes and the image for left eyes are displayed together with alternation on both sides of the black section in the shape of a vertical stripe.

That is, the image for left eyes is displayed on the pixel by which the image for right eyes was written to be the "left" to the pixel written to be the "right", and an image on either side is separated by the above-mentioned parallax barrier 4.

[0007] With such three dimensional display equipment, as an eye on either side is shown in drawing 19 and drawing 20 , respectively, an image equivalent to the image as which horizontal resolution was displayed on the liquid crystal panel with which the color filter of the shape of a half vertical stripe was used will be observed. For example, in the case of the parallax barrier system three dimensional display equipment using the liquid crystal panel whose pixel pitch is 0.11mm, an eye on either side becomes equivalent to seeing the image on the liquid crystal panel whose pixel pitch is 0.22mm, respectively.

[0008] Moreover, there is three dimensional display equipment which arranges the light filter 3 which has the vertical stripe-like protection-from-light section like drawing 21 as another method which can appreciate 3-dimensional scenography, without needing the conventional special glasses between a liquid crystal panel 2 and light equipment 1. Also in this method, resolution with a horizontal eye on either side will observe an image equivalent to the image displayed on the liquid crystal panel with which the color filter of the shape of a half vertical stripe was used like the case of a parallax barrier system.

[0009] There is three dimensional display equipment which arranges the light filter 4 which has the vertical stripe-like protection-from-light section in the observer side of a liquid crystal panel 2 like drawing 22 as still more nearly another conventional method, and arranges the light filter 3 which has the vertical stripe-like protection-from-light section between a liquid crystal panel 2 and light equipment 1 further. Also in this method, resolution with a horizontal eye on either side will observe an image equivalent to the image displayed on the liquid crystal panel with which the color filter of the shape of a half vertical stripe was used like the case of a parallax barrier system.

[0010]

[Problem(s) to be Solved by the Invention] By the way, generally, since human

being's eyes have the bad sensibility which receives blue, with the above images, the darkness of the part of the blue of a color filter is conspicuous, and they have the problem that it is sensed that black pinstripes exist.

[0011] This invention is made in view of the above-mentioned situation, and even when a color filter uses a vertical stripe-like liquid crystal panel, it aims at offering the three dimensional display equipment which can obtain clear 3-dimensional scenography.

[Means for Solving the Problem]

[0012] The graphic display panel arranged so that the 1st three dimensional display equipment of this invention may be located in a line by turns in all line and all trains in the pixel for left eyes which displays the pixel for right eyes which displays the image for right eyes, and the image for left eyes, It is arranged at the observer side of this graphic display panel, has opening corresponding to said pixel for right eyes, and the pixel for left eyes, and comes to have the light filter which separates the light from said pixel for right eyes, and the pixel for left eyes, and acts to an observer side as Idemitsu.

[0013] The light transmission mold graphic display panel arranged so that the 2nd three dimensional display equipment of this invention may be located in a line by turns in all line and all trains in the pixel for left eyes which displays the light equipment which emits light to a plane, the pixel for right eyes which displays the image for right eyes, and the image for left eyes, It is arranged between said light equipment and graphic display panels, has opening corresponding to said pixel for right eyes, and the pixel for left eyes, and comes to have the light filter which separates the light from said light equipment.

[0014] The light transmission mold graphic display panel arranged so that the 3rd three dimensional display equipment of this invention may be located in a line by turns in all line and all trains in the pixel for left eyes which displays the light equipment which emits light to a plane, the pixel for right eyes which displays the image for right eyes, and the image for left eyes, The 2nd light filter which is arranged between said light equipment and graphic display panels, has opening corresponding to said pixel for right eyes, and the pixel for left eyes, and separates the light from said light equipment, It is arranged at the observer side of said graphic display panel, has opening corresponding to said pixel for right eyes, and the pixel for left eyes, and comes to have the 1st light filter which separates the light from said pixel for right eyes, and the pixel for left eyes, and acts to an observer side as Idemitsu.

[0015]

[Function] According to this invention, each eye on either side will observe an image equivalent to the image displayed on a liquid crystal panel with the same horizontal pixel pitch as the horizontal pixel pitch of the liquid crystal panel to be

used. Therefore, there is no reduction of the horizontal number of pixel trains, and it is not sensed that pinstripes exist like before.

[0016]

[Example] Hereafter, the example of this invention is concretely explained based on a drawing. Drawing 1 is the decomposition perspective view of the three dimensional display equipment of the 1st example of this invention, a liquid crystal panel 2 is arranged in the front face of plane light equipment 1, and the light filter 6 which has opening of the letter of a check corresponding to the pixel array of this liquid crystal panel 2 is arranged at the observer side of a liquid crystal panel 2.

[0017] Drawing 2 is the expansion top view having shown the solid graphic display panel of this invention typically. The square frame in drawing is made to correspond to one pixel. In order that the liquid crystal panel 2 in this example may display the vertical line of an image vividly, the array of a color filter has become vertical stripe-like. In this drawing, "R", "G", and "B" express the pixel to which red, Green, and a blue color filter corresponded, respectively.

[0018] In this example, as shown in drawing 2, the image on a liquid crystal panel 2 is displayed that the pixel which displays the image for right eyes, and the pixel which displays the image for left eyes are located in a line by turns by all the lines M1, M2 --, and all the trains N1 and N2 --. in this example, the image of red (R) displays on the 1st train N1 -- having -- the image of the red of this N1 train -- a line writing direction -- the image for right eyes and the image for left eyes are most displayed by turns on an eye M1 by the object for right eyes, and the 2nd line M2 to the object for left eyes, a line writing direction M1, and M2 --. moreover -- the 2nd train N2 -- Green -- the image of (G) displays -- having -- the image of Green of this N2 train -- a line writing direction -- the image for left eyes and the image for right eyes are most displayed by turns on an eye M1 by the object for left eyes, and the 2nd line M2 to the object for right eyes, a line writing direction M1, and M2 --. furthermore, the image of blue (B) displays on the 3rd train N3 -- having -- the blue image of this N3 train -- a line writing direction -- the image for right eyes and the image for left eyes are most displayed by turns on an eye M1 by the object for right eyes, and the 2nd line M2 to the object for left eyes, a line writing direction M1, and M2 --. It is displayed that the pixel which displays the image for right eyes by all the lines M1, M2 --, and all the trains N1 and N2 --, and the pixel which displays the image for left eyes are hereafter located in a line by turns.

[0019] Therefore, although an image is displayed one by one in the direction of a train as red, Green, and blue by this liquid crystal panel 2, as for the pixel which a train and line both directions adjoin, the image for right eyes and the image for left eyes are displayed by turns.

[0020] Drawing 3 is the expansion top view having shown typically the light filter arranged in the front face of a liquid crystal panel 2, and as shown in this drawing, in order that a light filter 6 may separate the light which acts as Idemitsu, respectively from the right eye of a liquid crystal panel 2, and the pixel of a left eye, corresponding to the pixel configuration, opening 61 and the protection-from-light section 62 are arranged by turns in the shape of a check. One opening 61 of this light filter 6 corresponds to 2 pixels of a liquid crystal panel 2, only its pixel for right eyes (for left eyes) can be seen from an observer's right eye (left eye), and the pixel for left eyes (for right eyes) hides in the protection-from-light section, and is visible. Consequently, by the left eye, as shown in drawing 4, an observer will look at a screen by the right eye, as drawing 5 shows. The pitch of the horizontal pixel train in this case is the same as the pixel pitch of the liquid crystal panel 2 to be used. Therefore, there is no reduction of the horizontal number of pixel trains, and it is not sensed that pinstripes exist like before.

[0021] By the way, since what is necessary is for the eye on either side to have penetrated the light from an outstanding pixel, and just to have interrupted the light from a pixel in which the protection-from-light section 62 should hide, each may be separated like drawing 6, and, as for each opening 61 of a light filter 6, each may lap like drawing 7.

[0022] Also in the case of a multi-eye type with the larger number of views of the observer in an observation location than 2, this invention is applied. Drawing 8 is the graphic display on the liquid crystal panel 2 in the case of the three dimensional display equipment of 4 eye type. The pixel which displays the image corresponding to four views, respectively was expressed with 21-24. The light filter 6 in this case becomes like drawing 9.

[0023] The image on a liquid crystal panel may be displayed like drawing 10. In this case, a light filter becomes like drawing 11.

[0024] Although the method of presentation of an image other than these is considered, in any case, all the pixels that show the corresponding image from each view location of an observation location can be seen, and it should just form a light filter so that the pixel which displays other images may hide.

[0025] By the way, the pitch of the opening 61 of the light filter 6 of this invention is computed as follows.

[0026] Generally, each relation is as follows when a horizontal opening pitch [in / interocular distance / of Q and an observer / pitch / of P and a perpendicular direction / pitch / horizontal / N and / of a liquid crystal panel / pixel / for Bh and the opening pitch of the perpendicular direction of a light filter 6 / in E and the horizontal opening pitch of a light filter 6 / each line of Bv and a light filter 6] is set to Bo for the number of views of an observation location.

[0027]

[Equation 1] $Bo = N - P - E / (E + P)$ -- (1)

[0028]

[Equation 2] $Bh = P - E / (E + P)$ -- (2)

[0029]

[Equation 3] $Bv = E - Q / (E + P)$ -- (3)

[0030] Therefore, what is necessary is to calculate Bo for a horizontal opening pitch [in / for Bh and a vertical opening pitch / in the horizontal opening pitch of a light filter 6 / Bv and each line] based on the above-mentioned relational expression, and just to form a light filter 6.

[0031] With the three dimensional display equipment concerning the 2nd example of this invention shown in the decomposition perspective view of drawing 12, the light filter 5 with the opening 51 of the letter of a check is arranged between plane light equipment 1 and a liquid crystal panel 2.

[0032] In this case, although the list of the images 21-24 of each pixel becomes arrangement contrary to the case of the 1st example like drawing 13, the appearance of a light filter 5 is the same as said 1st example.

[0033] Each relation is as follows when the three dimensional display equipment constituted like the 2nd example generally sets a horizontal opening pitch [in / interocular distance / of Q and an observer / pitch / of P and a perpendicular direction / pitch / horizontal / N and / of a liquid crystal panel / pixel / for Bh and the opening pitch of the perpendicular direction of a light filter / in E and the horizontal opening pitch of a light filter 5 / each line of Bv and a light filter 5] to Bo for the number of views of an observation location.

[0034]

[Equation 4] $Bo = N - P - E / (E - P)$ -- (4)

[0035]

[Equation 5] $Bh = P - E / (E - P)$ -- (5)

[0036]

[Equation 6] $Bh = E - Q / (E - P)$ -- (6)

[0037] Therefore, what is necessary is to calculate Bo for a horizontal opening pitch [in / for Bh and a vertical opening pitch / in the horizontal opening pitch of a light filter 5 / Bv and each line] based on the above-mentioned relational expression, and just to form a light filter 5.

[0038] Since the configuration of others of this example, an operation, or effectiveness is the same as that of them of the 1st above-mentioned example, these explanation is omitted in order to avoid duplication.

[0039] With the three dimensional display equipment concerning the 3rd example of this invention shown in the decomposition perspective view of drawing 14, the light filter 6 with opening of the letter of a check is arranged to the observer side of a liquid crystal panel 2, and the light filter 5 which has opening of the letter of a

check further is arranged between light equipment 1 and a liquid crystal panel 2.

[0040] The opening pitch of the light filter 6 arranged at the observer side of a liquid crystal panel 2 is computed by - (formula 1) (formula 3). Moreover, the opening pitch of the light filter 5 arranged between light equipment 1 and a liquid crystal panel 2 is computed by - (formula 4) (formula 6).

[0041] Since the configuration of others of this example, an operation, or effectiveness is the same as that of them of the 1st above-mentioned example, these explanation is omitted in order to avoid duplication.

[0042] In each example mentioned above, the light filter 5 arranged between a liquid crystal panel 2 and light equipment 1 may form the protection-from-light section 52 for aluminum or a material with a high reflection factor like silver and a white coating. Moreover, the light equipment 1 side of the protection-from-light section 52 may be formed for aluminum or a material with a high reflection factor like silver and a white coating, and a liquid crystal panel 2 side may be formed for chromium, chrome oxide, and a material with a low reflection factor like the charge of black-colored. If such a light filter 5 is used, the light which was emitted from light equipment 1 and hit the protection-from-light section 52 will be reflected, and it will reflect in a light equipment 1 side again in the case of return and light equipment 1. such reflection -- repeating -- just -- being alike -- light passes the opening 51 of a light filter 5. The use effectiveness of light increases according to this operation.

[0043] Moreover, the light filters 5 and 6 of this invention can be manufactured by removing the sensitization agent of the part which carries out melanism to the part used as the protection-from-light section of the sensitization agent applied for example, on the glass substrate and which irradiates laser, and has not carried out melanism to it.

[0044] Furthermore, the light filters 5 and 6 of this invention can also be manufactured using printing techniques, such as screen-stencil and offset printing.

[0045] Moreover, the light filters 5 and 6 of this invention can also be manufactured by vapor-depositing aluminum and chromic oxide and forming by etching on a glass substrate.

[0046] Furthermore, the light filters 5 and 6 of this invention can also be manufactured by forming the protection-from-light section of nickel and chrome oxide according to electrodeposition on a glass substrate.

[0047] In addition, although the liquid crystal panel is used for each example mentioned above as a display, the same effectiveness is acquired, even if it uses the display of a luminescence mold in addition to a liquid crystal panel so that it may be CRT etc.

[0048]

[Effect of the Invention] As explained above, when the color filter of a liquid crystal panel is a vertical stripe according to this invention, an eye on either side will observe an image equivalent to the image displayed on the liquid crystal panel as the pixel pitch of the liquid crystal panel to be used with the same pitch of a pixel train. Therefore, there is no reduction of the horizontal number of pixel trains, and the pinstripes sensed become the pinstripes and EQC which are sensed with the liquid crystal panel to be used.

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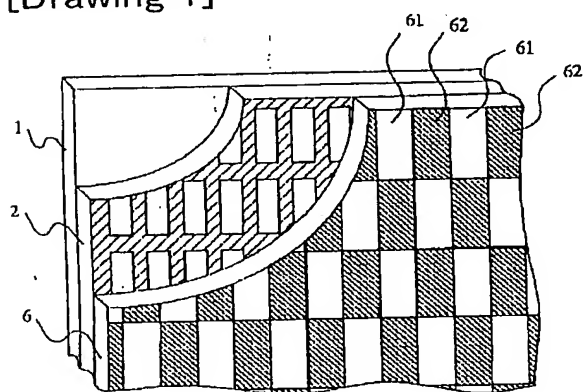
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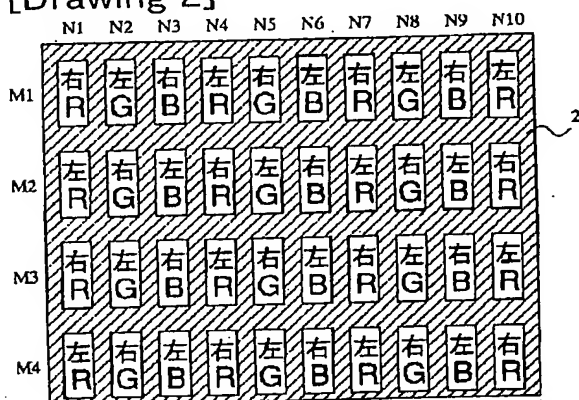
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DRAWINGS

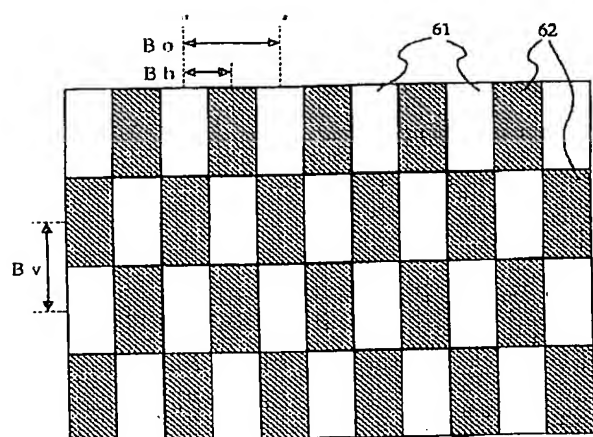
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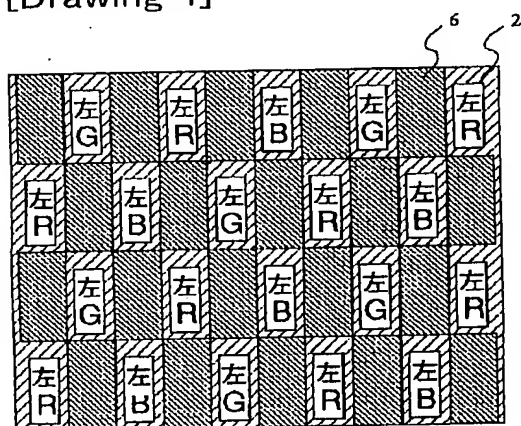
[Drawing 2]



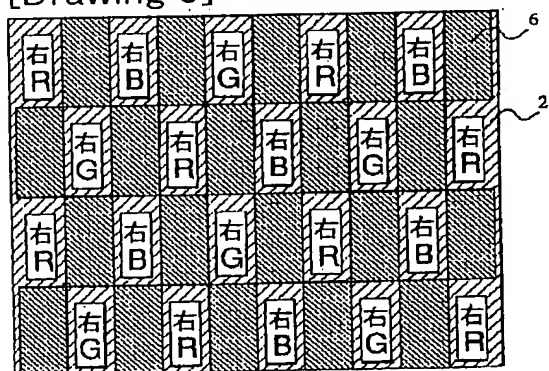
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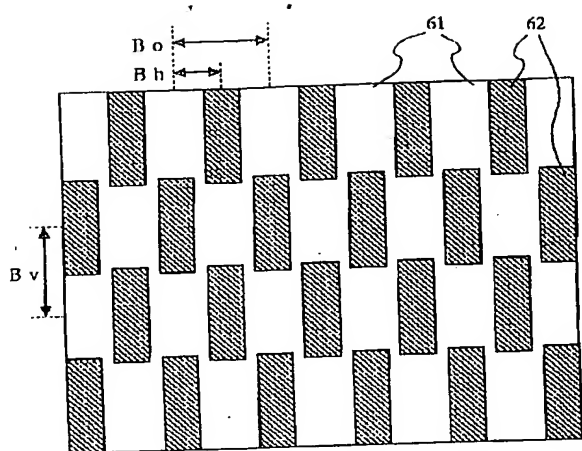
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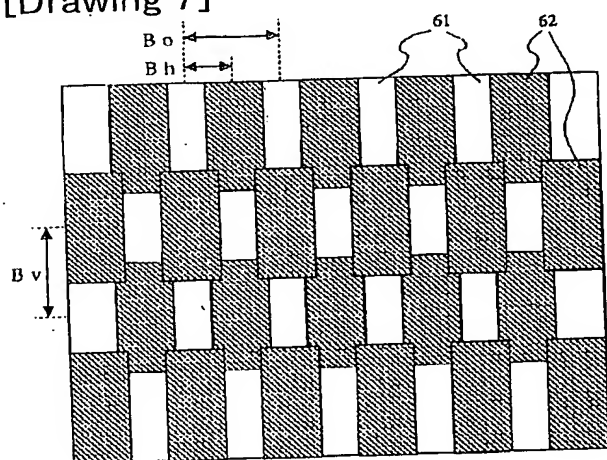
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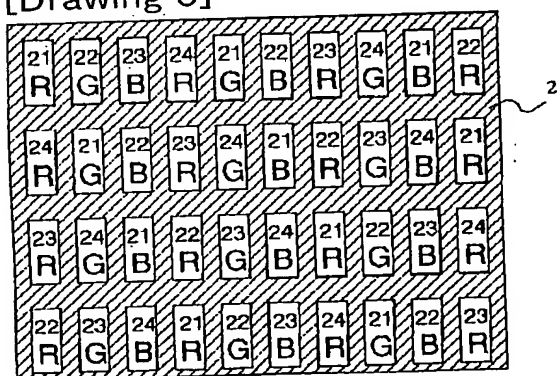
[Drawing 6]



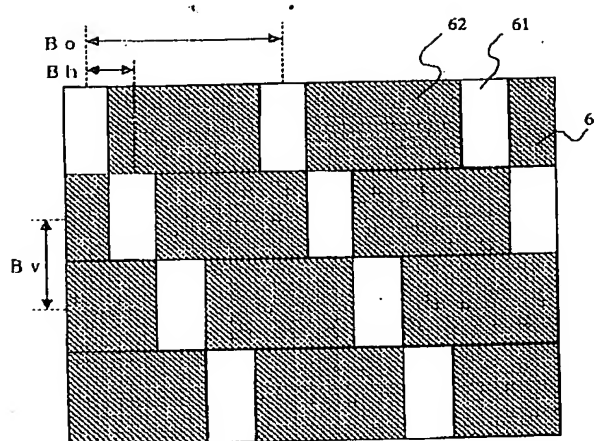
[Drawing 7]



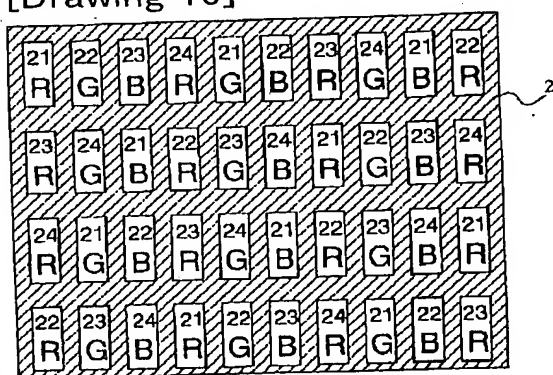
[Drawing 8]



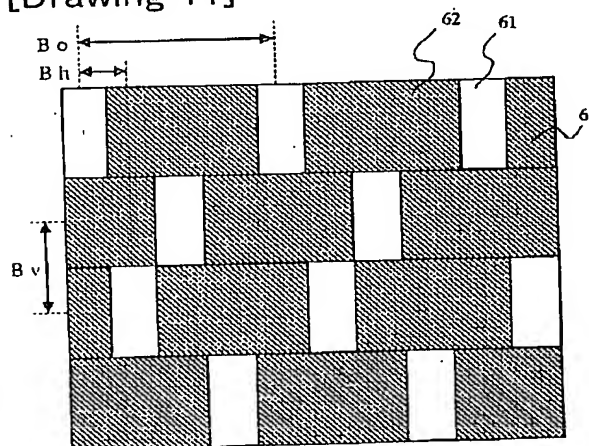
[Drawing 9]



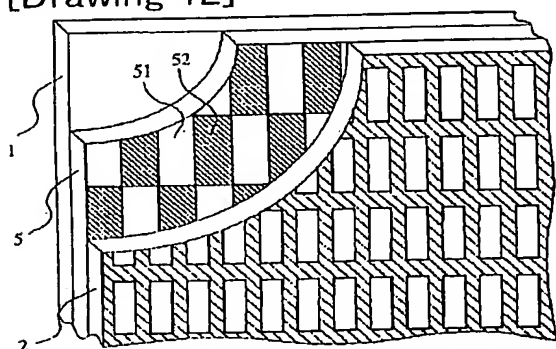
[Drawing 10]



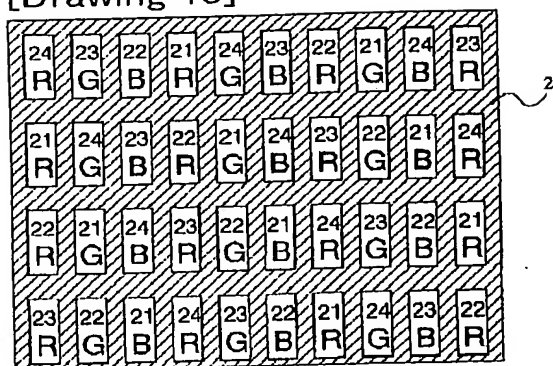
[Drawing 11]



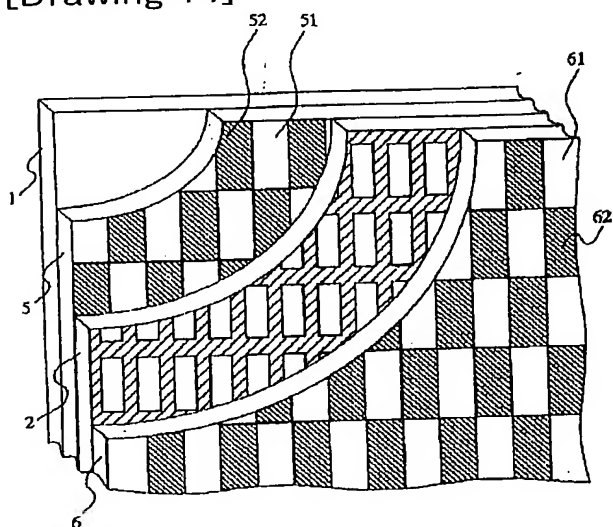
[Drawing 12]



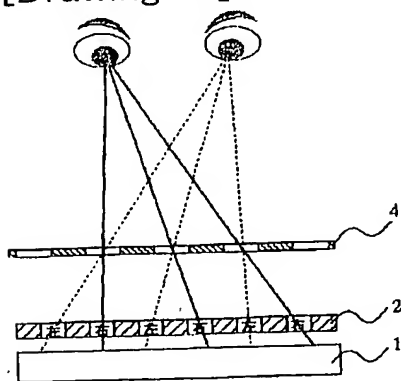
[Drawing 13]



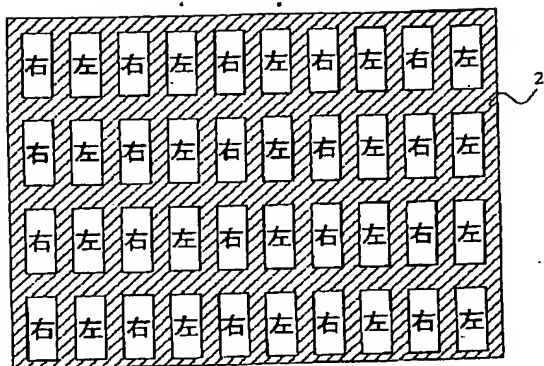
[Drawing 14]



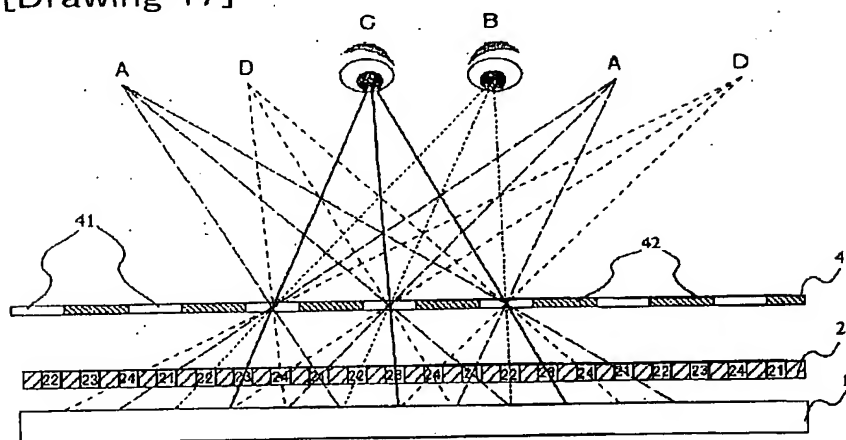
[Drawing 15]



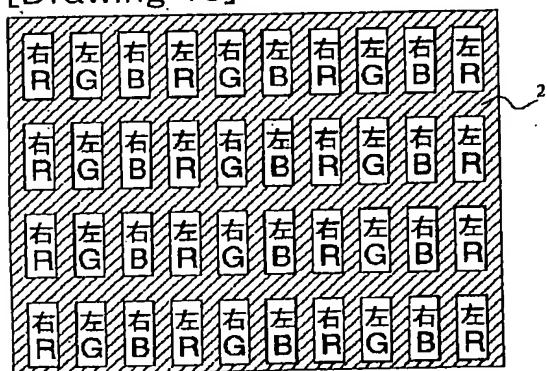
[Drawing 16]



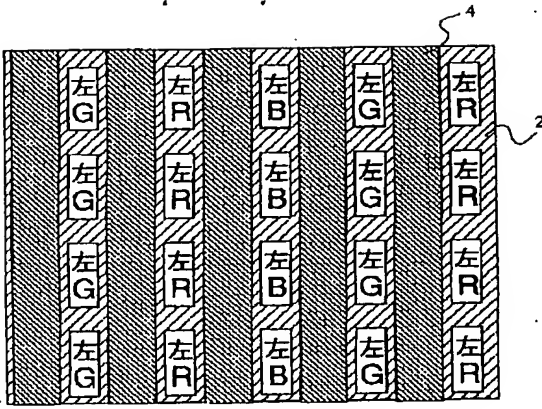
[Drawing 17]



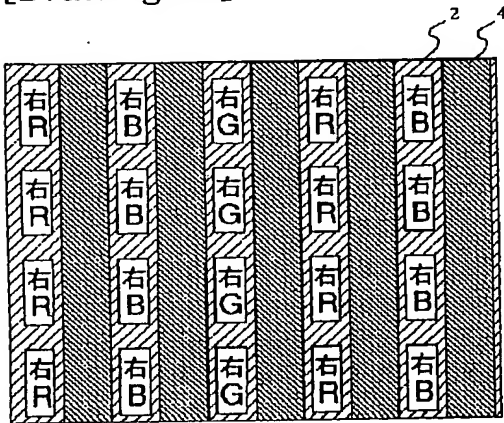
[Drawing 18]



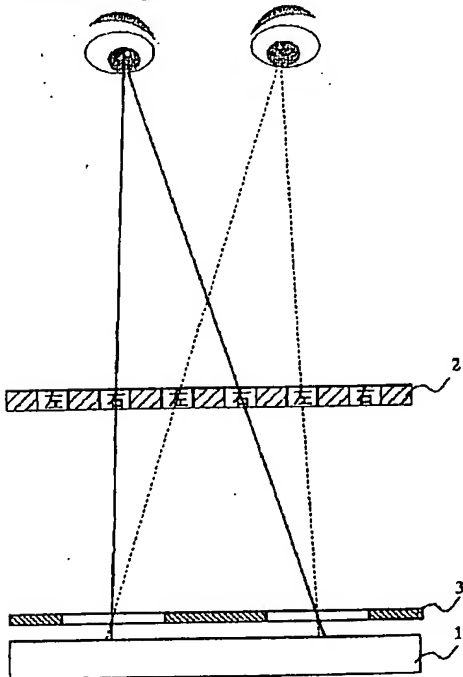
[Drawing 19]



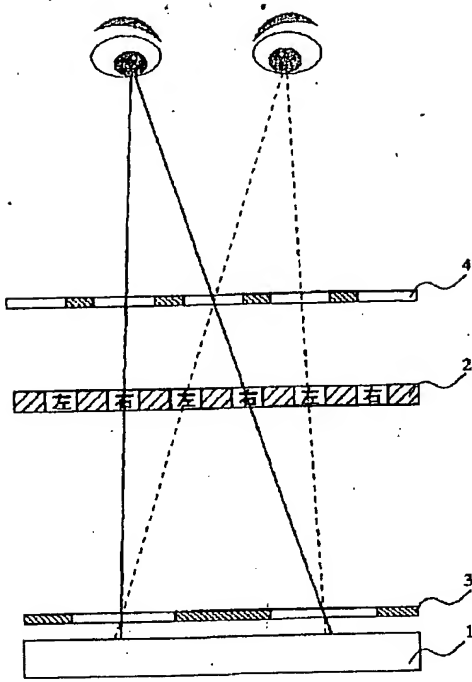
[Drawing 20]



[Drawing 21]



[Drawing 22]



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